

June 10, 2011

Mr. Kelly Madalinski
Port of Portland
7200 NE Airport Way
Portland, Oregon 97218

Re: Proposed Riverbank Sampling — Operable Unit 2
Swan Island Upland Facility
Portland, Oregon
ECSI No. 271
1115-05

Dear Mr. Madalinski:

This letter presents the proposed riverbank sampling activities to support the preparation of an addendum to the *Source Control Evaluation* (SCE; Ash Creek, 2010) for Operable Unit 2 (the Facility or OU2) at the Swan Island Upland Facility (SIUF) in Portland, Oregon (Figures 1 and 2). The Port of Portland (Port) is under a Voluntary Cleanup Program (VCP) Agreement with the Oregon Department of Environmental Quality (DEQ) for Remedial Investigation (RI), Source Control Measures (SCMs), and Feasibility Study (FS) at the Facility (dated July 24, 2006). The proposed activities presented in this letter include collection of surface soil samples for chemical analysis.

BACKGROUND

An SCE (Ash Creek, 2010) was prepared for the Facility using the Portland Harbor Joint Source Control Strategy (JSCS) as guidance. The DEQ provided comments on the SCE in a letter dated August 9, 2010, requesting additional lines of evidence to demonstrate that erosion of riverbank surface soils will not pose a recontamination risk. In October 2010, Ash Creek completed a visual reconnaissance of the riverbank. Areas of riverbank erosion were identified. The Port notified DEQ of the results of the visual reconnaissance and a site meeting was completed on April 18, 2011. The DEQ agreed that additional chemical data is necessary to understand the significance of the erosional areas and complete an SCE Addendum.

RIVERBANK RECONNAISSANCE

On October 6 and 7, 2010, Ash Creek completed a visual reconnaissance of the OU2 riverbank. The entire length of the bank was observed and mapped. Figure 3 shows the results of the visual mapping, identifying observed geomorphic features.

In general, the surface condition of the riverbank is characterized by dense vegetation above the approximate ordinary line of high water (OLHW – identified based on visual determination of the location where predominantly upland vegetation was present). Vegetation generally consists of grasses and shrubs. Below the OLHW, the bank generally consists of rip rap with occasional sandy beaches.

Locally, various surface features (designated A through Q) were observed and mapped. The location and ground elevation of observed erosion features were surveyed by a licensed surveyor (where accessible at the time of the survey). The observed features are identified on Figure 3 and discussed below.

- A – Bare ground with dimensions of approximately 4 feet by 8 feet. This area is adjacent to a ship tie-down. There is evidence of prior attempts to landscape around the tie-down – plastic sheeting and bark mulch observed.
- B – Bare ground approximately 1 foot in diameter.
- C – Outfall WR-399.
- D – Bare ground located below the OLHW with dimensions of approximately 80 feet long by 3 feet wide. This feature appears to be related to outfall WR-399. The soil in the exposed surface differs from that observed elsewhere on the riverbank and in upland borings. Instead of primarily sand that is observed elsewhere, the soil at this location consists of clayey silt exhibiting some cohesiveness. Additionally, instead of rip rap below this area, the slope consists of a sandy beach. This feature was below the river surface at the time of the survey (January 24, 2011). Mean river elevation at the Morrison Bridge on January 24, 2011 was 12.4 feet NGVD).
- E – Depression in riverbank. This feature is approximately 30 feet wide and exhibits the characteristics of historical disturbance to the bank. This is the location of former outfall pipe CG-26 that was removed in October 2008. This feature is covered with dense vegetation and shows no signs of current erosion. The slope below this area is characterized by a combination of rip rap and sandy beach.
- F – Inactive outfall pipe CG-28 located below OLHW.
- G – War-era shipyard Substation A concrete platform.
- H – Manway to breasting dolphin.
- I – Erosion scarp. This feature is located near the OLHW (toe elevation of 15.3 to 15.9 feet NGVD) with a length of 35 feet. The maximum height of the scarp is 1.5 feet, but for most of its length, the scarp is less than 6 inches high. This feature is below the approximate location of former outfall WR-160 that was removed in August 2006.
- J – Erosion scarp. The scarp appears to be located near the OLHW. The scarp length is 635 feet. The average height is 3.1 feet and the maximum height is 6.6 feet. The northern 375 feet of the scarp is located near the OLHW (toe elevation varies from 15.0 to 21.9 feet NGVD). The southern 260 feet of the scarp is above the OLHW (toe elevation varies from 18.4 to 20.0 NGVD). In one area, a second smaller scarp (length of about 30 feet) is present above the primary scarp.
- K – Aggregate conveyor.
- L – Erosion scarp. The scarp is above the OLHW (toe elevation of 19.5 to 20.8 feet NGVD), 56 feet long, and up to 3.0 feet high.
- M – Erosion scarp. The scarp is above the OLHW (toe elevation of 20.3 to 21.8 feet NGVD), 53 feet long, and up to 2.7 feet high.
- N – Erosion scarp within depression in riverbank. The scarp is above the OLHW (toe elevation of 21.1 to 22.9 feet NGVD), 49 feet long, and up to 2.0 feet high. The depressed riverbank is approximately 80 feet wide and exhibits the characteristics of historical disturbance to the bank. This feature is covered with dense vegetation and shows no signs of current erosion associated with the depression. The slope below this area is characterized by a combination of rip rap and sandy beach.
- O – Depression in riverbank. This feature is approximately 50 feet wide and exhibits the characteristics of historical disturbance to the bank. This feature is covered with dense vegetation and shows no signs of current erosion.



- P – Erosion scarp. The scarp is near the OLHW (toe elevation of 15.1 to 15.5 feet NGVD), 2.1 feet long, and up to 1.1 feet high.
- Q – Outfall 163.

In summary, the riverbank is characterized by dense vegetation with 17 observed surface features. Six of these features are structures (C, F, G, H, K, and Q). In addition, two features consist of historical bank disturbance (some associated with historical outfalls no longer present) but the surface is now densely vegetated and there was no evidence of current erosion (E and O). Two features (A and B) are bare ground high on the bank with a total surface area of approximately 30 square feet. One feature (D) consists of bare ground (total surface area of approximately 240 square feet) apparently associated with outfall WR-399. Finally, six features consist of visible erosion scarps (I, J, L, M, N, and P). The erosion scarps are discussed further below.

The erosion scarps are linear features running parallel to the riverbank. They are located at or above the transition from rip rap to vegetated riverbank. The total length of the scarps is 830 feet. Of that total, approximately 300 feet of the scarps encroach below the OLHW (toe elevations ranging from 15.0 to 16.6 feet NGVD). The observed characteristics of the erosion appear to be consistent with erosion resulting from wave action (caused primarily by vessel wakes). The majority of the riverbank is covered with rip rap or dense vegetation and has no evidence of erosion, demonstrating that rip rap and vegetation are effective. It is likely that the erosion scarps originated in areas with a poor transition from rip rap to dense vegetation. For example, if the top elevation of the rip rap is below the OLHW in a particular location, upland vegetation at that transition may struggle to sustain dense growth from year to year. If, during a down year for vegetation, the river level is sustained at a level just above the rip rap, vessel-wake action could initiate erosion that leads to a small vertical scarp. As long as the water level is above or below the location of the erosion scarp, no substantive erosion would occur. Whenever the water level is at the level of the scarp, however, the bank would be subject to additional erosion. Observations of the riverbank support this model. For example, at multiple locations, the vegetation has become well-established below the location of the erosion scarp. This indicates that growing seasons passed without substantial erosion of the scarp.

The exposed erosion scarps allowed observation of the soil conditions on the riverbank. In the exposed face of the scarps (generally between elevations 15 to 25 feet), soil conditions were observed to consist of 18 to 24 inches of silty, sandy gravel (with angular gravel up to four inches in diameter) overlying fine to medium sand. At feature D, the soil consists of clayey silt. This feature is below elevation 12 feet.

Combining the observation of soil conditions with a general knowledge of the development of Swan Island yields the following model for the geologic conditions of the OU2 riverbank.

- Dredge sands (fine to medium sand observed in erosion scarps) 20 to 25 feet thick overlie native alluvial silts (clayey silt outcrop observed below elevation 12 feet at feature D).
- An 18- to 24-inch layer of erosion protection materials were placed on the riverbank at the time of construction. These materials consist of rip rap below the OLHW and 4-inch minus crushed silt/sand/gravel above the OLHW.

PROPOSED SAMPLING ACTIVITIES

Preparatory Activities

The following activities and schedule coordination will be completed in preparation for the field work.

- **Health and Safety Plan (HASP).** Ash Creek will prepare a HASP for its personnel involved with the project.
- **Underground Utility Location.** An underground utility locate will be conducted prior to the sampling activities.

Soil Sample Station Locations

Seven features consisting of bare soil or an erosion scarp were identified on the riverbank (D, I, J, L, M, N, and P). Sample stations will be established to collect representative samples from these features as follows.

- Features D, I, L, M, and N (D is bare soil and the others are erosion scarps) range in length from 35 to 80 feet with heights of 1.5 to 3 feet. One sampling station will be established at each feature, located at the observed maximum scarp height.
- Feature J is an erosion scarp that is 635 feet long and up to 6.6 feet in height. Three sample stations will be established for this feature the following criteria in order of priority:
 - Station spacing of at least 100 feet;
 - Scarp free of vegetation; and
 - Higher portions of the scarp.
- Feature P is only 2 feet long and consequently will not be sampled.

Figure 4 shows the general proposed locations of the soil sampling stations. Final locations will be established in the field following the criteria above.

Soil Sampling at Each Station

Two discrete soil samples will be collected at each sample station. The samples will be labeled RB-#a and RB-#b where “#” represents a sequential sample number beginning with “8”. The samples will be collected from the following locations.

- “a” Sample – The “a” sample will be collected from the top of the erosion scarp beginning two inches back from the face of the scarp and from a depth of 0 to 6 inches from the ground surface at the top of the scarp.
- “b” Sample – The “b” sample will be collected from the face of the erosion scarp beginning two inches back from the face of the scarp and over a depth interval of 6 inches maximum. The height of the center of the sample location will be determined as follows.
 - Where the exposed soil in the scarp is of a single type, the sample will be located vertically in the center of the scarp.
 - Where the exposed soil has at least two different soil types visible, the sample will be located vertically in the center of the second layer down from the surface.

Soil Sampling Methodology

The samples will be collected in accordance with Standard Operating Procedure (SOP) 2.2 (Attachment A). The samples will be field screened for volatile organic compounds (VOCs) using a photoionization detector (PID) and for the presence of petroleum hydrocarbons using a sheen test in accordance with SOP 2.1. Each sample station will be photographed with the actual sample locations clearly delineated. The soil conditions where each sample is collected will be described in the field notes.

The sample locations will be recorded using a high-accuracy, handheld global positioning system (GPS) device (Trimble® GeoXH™).

CHEMICAL ANALYSES

The Contaminants of Interest (COI) detected above background and screening levels and carried forward as Contaminants of Potential Concern (COPCs) in the SCE are:

- Arsenic, cadmium, copper, lead, and zinc;
- Indeno(1,2,3-cd)pyrene and benzo(g,h,i)perylene;
- Total polychlorinated biphenyls (PCBs); and
- Tributyltin (TBT).

However, based on the discussion below, there is sufficient TBT data to complete the SCE. Therefore, soil samples will be submitted for the following chemical analyses on a normal turnaround basis. Target reporting limits are presented in Table 1.

- Arsenic, cadmium, copper, lead, and zinc by EPA Method 6020;
- Polycyclic aromatic hydrocarbons by EPA 8270-SIM; and
- PCBs by EPA Method 8082 (Aroclors 1016, 1221, 1232, 1242, 1248, 1254, 1260, 1262, and 1268).

TBT Data Evaluation. Riverbank and adjacent sediment data are presented in the SCE (Ash Creek, 2010). Results for TBT are summarized as follows.

Riverbank Surface Soil

Samples Analyzed	12
Number of Samples with Detected Concentration	8
Detection Limit Range	4.9 – 5.0 µg/kg
Minimum Detection	7 µg/kg
Maximum Detection	580 µg/kg
90% Upper Confidence Limit of Mean	190 µg/kg

Surface Sediment

Samples Analyzed	4
Number of Samples with Detected Concentration	3
Detection Limit	5.7 µg/kg
Minimum Detection	19 µg/kg
Maximum Detection	31 µg/kg

In the draft baseline ecological risk assessment (BERA; Windward Environmental, 2009) prepared for the Portland Harbor Remedial Investigation, TBT was evaluated for a range of potential ecological endpoints and identified as a COPC for two main endpoints: fish diet and benthic toxicity. These are further assessed below.

- **Fish Diet.** For fish diet, the sediment Preliminary Remediation Goals (PRGs) for TBT presented in the April 21, 2010 memorandum from EPA (EPA, 2010) are 5.9 and 3.8 mg/kg organic carbon (OC). As discussed in a subsequent memorandum to EPA (Windward Environmental, 2010), these original PRGs were calculated using a toxicity reference value (TRV) based on a single study of dietary TBT toxicity to fish. Although that study had significant uncertainty, it was used for lack of better information. Since publication of the draft BERA, further review of the literature identified four additional studies containing fish TRVs for TBT. These additional studies were evaluated and a revised fish dietary TRV for TBT was recommended. The recommended revised TRV is 0.15 mg/kg body weight per day versus the originally used value of 0.002 mg/kg body weight per day (see lowest-observed-adverse-effect level [LOAEL] in first two rows of

Table 1 in Windward Environmental, 2010). Using the revised TRV, the corresponding sediment PRGs for fish diet would be 440 and 280 mg/kg OC. Furthermore, assuming an average OC content for Portland Harbor sediment of one percent, the equivalent whole sediment PRGs would be 4,400 and 2,800 µg/kg.

- **Benthic Toxicity.** In Table 6-10 of the draft BERA, the benthic Level 2 Sediment Quality Value (L2 SQV) for TBT is listed as 3,080 µg/kg.

Based on the above, there are multiple lines of evidence that TBT is not a significant COPC for the SCE, summarized as follows:

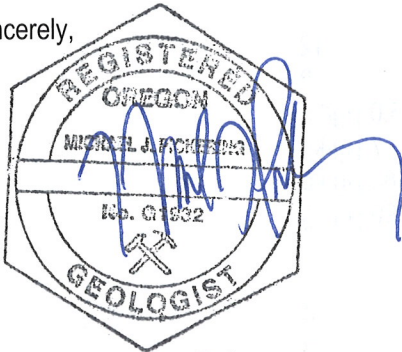
- Given the recommended revision to the TBT fish TRV and benthic L2 SQV, TBT is not likely to be a substantive COC in the harbor sediments;
- The surface sediment data demonstrate that TBT is not a contaminant of concern in the sediments adjacent to OU2;
- The existing riverbank soil data for TBT are below the lowest revised sediment PRG (15 and 5 times less for the mean and maximum detected, respectively).

REPORTING

The results of the sampling will be presented in the SCE addendum.

If you have any questions regarding these activities, please contact the undersigned at (503) 924-4704.

Sincerely,



Michael J. Pickering, R.G.
Associate Hydrogeologist

Herbert F. Clough, P.E.
Principal

ATTACHMENTS

Table 1 – Target Reporting Limits

Figure 1 – Facility Location Map

Figure 2 – Facility Vicinity Map

Figure 3 – Riverbank Reconnaissance Results

Figure 4 – Proposed Sampling Plan

Attachment A – Standard Operating Procedures 2.1 and 2.2



REFERENCES

- Ash Creek, 2010. *Source Control Evaluation, Operable Unit 2, Swan Island Upland Facility, Portland, Oregon*. April 15, 2010.
- EPA, 2010. *Portland Harbor Superfund Site; Administrative Order on Consent for Remedial Investigation and Feasibility Study; Docket No. CERCLA-10-2001-0240*. April 21, 2010.
- Windward Environmental, 2009. *Portland Harbor RI, Appendix G: Baseline ecological risk assessment (Draft)*, Prepared for the Lower Willamette Group.
- Windward Environmental, 2010. *Memorandum, Evaluation of TBT Risk to Fish in Portland Harbor*. October 28, 2010.

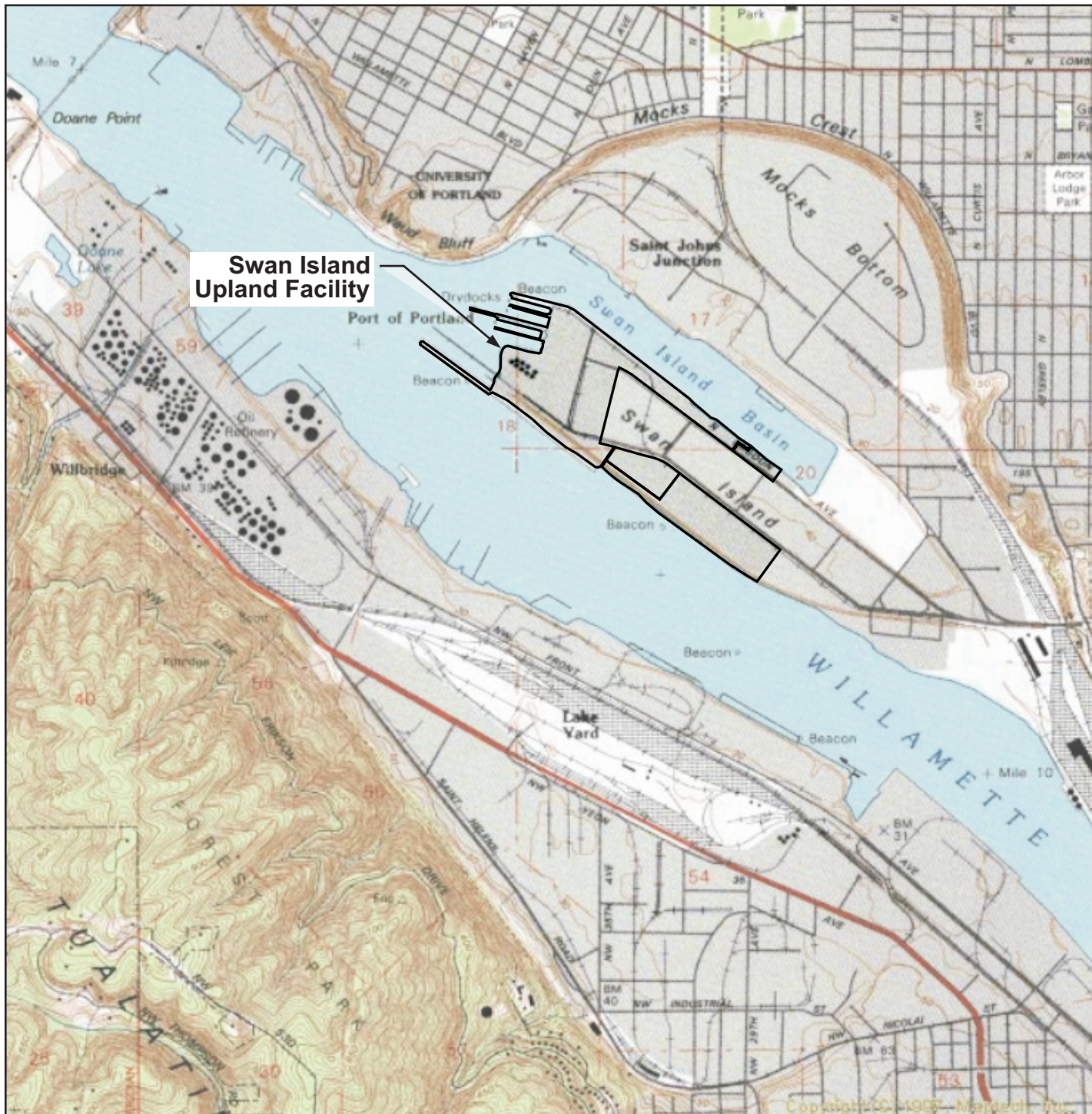
Table 1 - Target Reporting Limits
Swan Island Upland Facility, OU2
Portland, Oregon

Analyte	Soil			
	Units	MDL	MRL	JSCS
<i>Metal (EPA 6000/7000 Series Methods)</i>				
Arsenic	mg/kg	0.097	0.5	7
Cadmium	mg/kg	0.022	0.08	1
Copper	mg/kg	0.15	0.5	149
Lead	mg/kg	0.031	0.1	17
Zinc	mg/kg	1.4	5	459
<i>Polycyclic Aromatic Hydrocarbons (EPA Method 8270-SIM)</i>				
1-Methylnaphthalene	ug/kg	0.9	6.7	--
2-Methylnaphthalene	ug/kg	1.8	6.7	200
Acenaphthene	ug/kg	1.5	6.7	300
Acenaphthylene	ug/kg	0.2	6.7	200
Anthracene	ug/kg	0.4	6.7	845
Benzo(a)anthracene	ug/kg	0.1	6.7	--
Benzo(a)pyrene	ug/kg	0.2	6.7	--
Benzo(b)fluoranthene	ug/kg	0.7	6.7	--
Benzo(ghi)perylene	ug/kg	0.3	6.7	--
Benzo(k)fluoranthene	ug/kg	0.5	6.7	--
Chrysene	ug/kg	0.3	6.7	1,290
Dibenz(a,h)anthracene	ug/kg	0.3	6.7	--
Fluoranthene	ug/kg	0.8	6.7	2,230
Fluorene	ug/kg	0.8	6.7	536
Indeno(1,2,3-cd)pyrene	ug/kg	0.3	6.7	--
Naphthalene	ug/kg	1.8	6.7	561
Phenanthrene	ug/kg	3.1	6.7	1,170
Pyrene	ug/kg	0.3	6.7	1,520
<i>Polychlorinated Biphenyls (EPA Method 8082)</i>				
Aroclor 1016	ug/kg	5	17	530
Aroclor 1221	ug/kg	3	17	--
Aroclor 1232	ug/kg	4	17	--
Aroclor 1242	ug/kg	5	17	--
Aroclor 1248	ug/kg	5	17	1,500
Aroclor 1254	ug/kg	3	17	300
Aroclor 1260	ug/kg	6	17	200
Aroclor 1262	ug/kg	2	17	--
Aroclor 1268	ug/kg	2	17	--

Notes:

1. -- = Not available or not applicable.
2. MDL = Method detection limit (MDL).
3. MRL = Method reporting limit (MRL).
4. JSCS = Screening levels from Portland Harbor Joint Source Control Strategy – Final (Table 3-1 Updated July 16, 2007). December 2005.

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NOTE: Base map prepared from USGS 7.5-minute quadrangles as provided by Topozone. (1990)

0 2,000 4,000
Approximate Scale in Feet



Facility Location Map

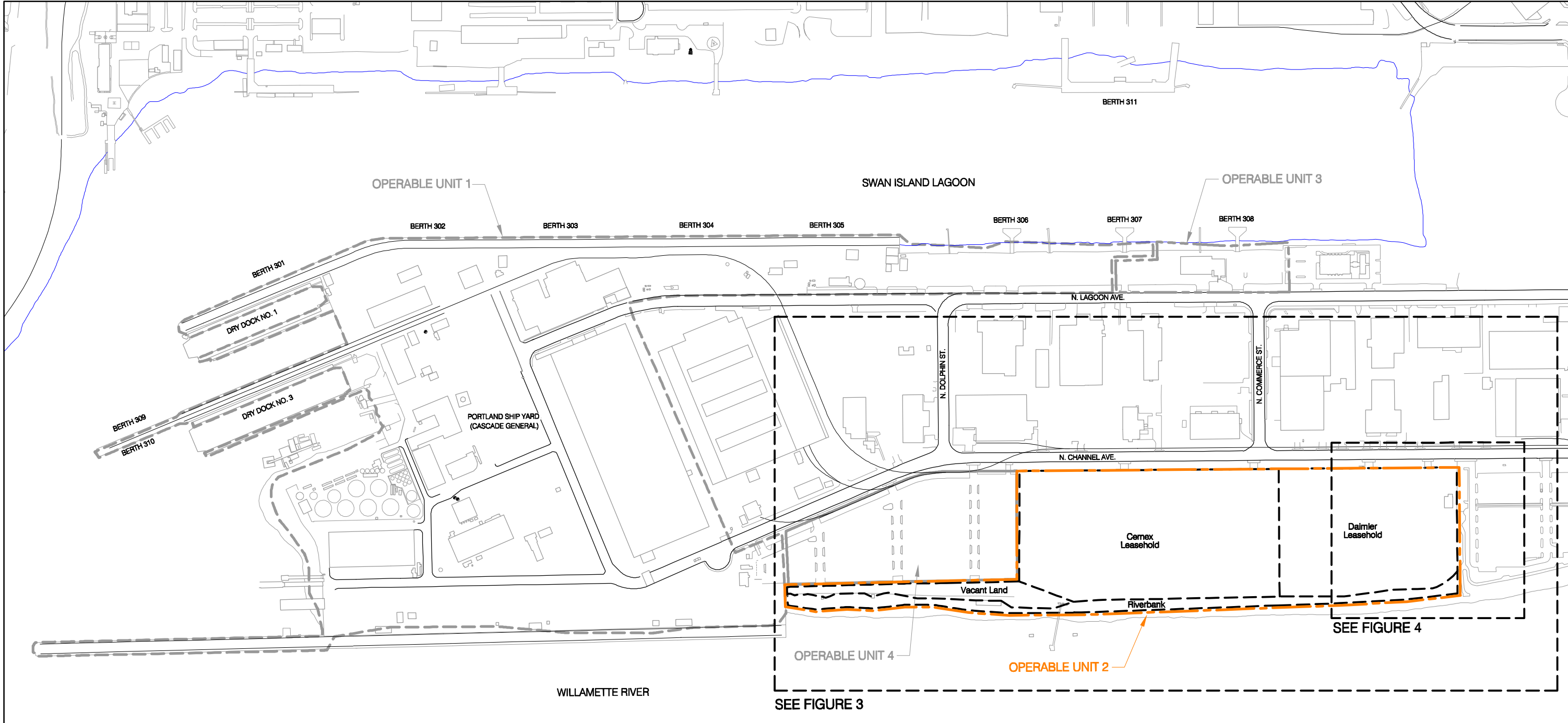
Proposed Surface Soil Sampling Letter
Swan Island Upland Facility Operable Unit 2
Portland, Oregon



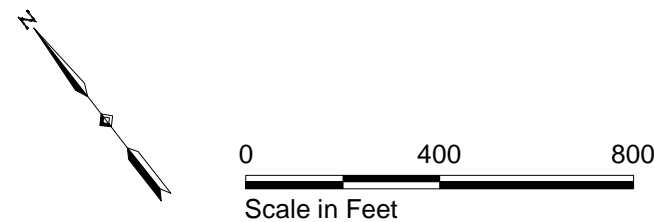
Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

Project Number 1115-05
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Figure
1



- Legend:**
- Operable Unit 1 Boundary
 - Operable Unit 2 Boundary
 - Operable Unit 3 Boundary
 - Operable Unit 4 Boundary
 - [] Exposure Area and Designation





NOTE:
 1. Prepared from AutoCAD base map received from the Port of Portland in June 2007.

<h3>Facility Vicinity Plan</h3> <p>Proposed Surface Soil Sampling Letter Swan Island Upland Facility Operable Unit 2 Portland, Oregon</p>		
 Ash Creek Associates, Inc. <small>Environmental and Geotechnical Consultants</small>	Project Number	1115-05
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		Figure 2



Legend:

- WR-399  Outfall Location and Designation
- WR-160  Storm Water Pipe Location and Designation (Abandoned July 2006)

NOTES:

1. Prepared from AutoCAD base map received from the Port of Portland in June 2007.

2. Aerial photograph from 2010 - Google Imagery dated June 19, 2008.

Riverbank Reconnaissance Results

Riverbank Surface Soil Sampling Work Plan
Swan Island Upland Facility Operable Unit 2
Portland, Oregon



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Legend:


- 
WR-160

Outfall Location and Designation
Storm Water Pipe Location and Designation
(Abandoned July 2006)
- 
RB-4

Proposed Riverbank Soil Sampling Location
(RB-8 through RB-15)
Historical Riverbank Sample Location
(RB-1 through RB-7)

NOTES:
1. Prepared from AutoCAD base map received from the Port of Portland in June 2007.
2. Aerial photograph from 2010 - Google Imagery dated June 19, 2008.

Proposed Sampling Plan
Riverbank Surface Soil Sampling Work Plan
Swan Island Upland Facility Operable Unit 2
Portland, Oregon

 Ash Creek Associates, Inc.
Environmental and Geotechnical Consultants

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Attachment A

Standard Operating Procedures 2.1 and 2.2

1. PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) provides instructions for standard field screening. Field screening results are used to aid in the selection of soil samples for chemical analysis. This procedure is applicable during all Ash Creek Associates (ACA) soil sampling operations.

Standard field screening techniques include the use of a photoionization detector (PID) to assess for volatile organic compounds (VOCs), for the presence of separate-phase petroleum hydrocarbons using a sheen test. These methods will not detect all potential contaminants, so selection of screening techniques shall be based on an understanding of the site history. The PID is not compound or concentration-specific, but it can provide a qualitative indication of the presence of VOCs. PID measurements are affected by other field parameters such as temperature and soil moisture. Other field screening methods, such as screening for dense non-aqueous phase liquid (DNAPL) using dye or UV light, are not considered "standard" and will be detailed in the site-specific sampling and analysis plan (SAP).

2. EQUIPMENT AND MATERIALS

The following materials are necessary for this procedure:

- PID with calibration gas (record daily calibration/calibration check in field notes);
- Plastic resealable bags (for PID measurement); and
- Glass jars or stainless steel bowls (for sheen testing).

3. METHODOLOGY

Each soil sample will be field screened for VOCs using a PID and for the presence of separate-phase petroleum hydrocarbons using a sheen test. If the presence of DNAPL is suspected, then screening using dye and UV light may also be completed. For information regarding screening using dye or UV light, refer to the site specific sampling and analysis plan.

PID lamps come in multiple sizes, typically 9.8, 10.6, and 11.7 electron volts (eV). The eV rating for the lamp must be greater than the ionization potential (in eV) of a compound in order for the PID to detect the compound. For petroleum hydrocarbons, a lamp of at least 9.8 eV should be used. For typical chlorinated alkenes (dichloroethene, trichloroethene, tetrachloroethene, or vinyl chloride.), a lamp of at least 10.6 eV should be used. The compatibility of the lamp size with the site constituents should be verified prior to the field event and will be detailed in the site-specific SAP.

PID Calibration Procedure: The PID used on-site should be calibrated daily or more frequently if needed. Calibration of the PID should be documented in field notes. Calibrations procedures should be conducted according to the manufacturer's instructions. .

PID Screening Procedure:

- Place a representative portion (approximately one ounce) of freshly exposed, uncompacted soil into a clean resealable plastic bag.
- Seal the bag and break up the soil to expose vapors from the soil matrix.
- Allow the bag to sit to reach ambient temperature. Note: Ambient temperature and weather conditions/humidity should be recorded in field notes. Changes in ambient temperature and weather during the field work should also be recorded, as temperature and humidity can affect PID readings.
- Carefully insert the intake port of the PID into the plastic bag.
- Record the PID measurement in the field notes or boring logs.

Sheen Test Procedure:

- Following the PID screen, place approximately one ounce of freshly exposed, uncompacted soil into a clean glass jar or stainless steel bowl.

STANDARD OPERATING PROCEDURE

SOP Number: 2.1

Date: November 9, 2009

STANDARD FIELD SCREENING PROCEDURES

Revision Number: 1.1

Page: 2 of 2

- Add enough water to cover the sample.
- Observe the water surface for signs of discoloration/sheen and characterize

No Sheen (NS)	No visible sheen on the water surface
Biogenic Film (BF)	Dull, platy/blocky or foamy film.
Slight Sheen (SS)	Light sheen with irregular spread, not rapid. May have small spots of color/iridescence. Majority of water surface not covered by sheen.
Moderate Sheen (MS)	Medium to heavy coverage, some color/iridescence, spread is irregular to flowing. Sheen covering a large portion of water surface.
Heavy Sheen (HS)	Heavy sheen coverage with color/iridescence, spread is rapid, entire water surface covered with sheen. Separate-phase hydrocarbons may be evident during sheen test.

1. PURPOSE AND SCOPE

This Standard Operating Procedure (SOP) describes the methods used for obtaining surface soil samples for physical and/or chemical analysis. For purposes of this SOP, surface soil (including shallow subsurface soil) is loosely defined as soil that is present within 3 feet of the ground surface at the time of sampling. Various types of sampling equipment are used to collect surface soil samples including spoons, scoops, trowels, shovels, and hand augers.

2. EQUIPMENT AND MATERIALS

The following materials are necessary for this procedure:

- Spoons, scoops, trowels, shovels, and/or hand augers. Stainless steel is preferred.
- Stainless steel bowls
- Laboratory-supplied sample containers
- Field documentation materials
- Decontamination materials
- Personal protective equipment (as required by Health and Safety Plan)

3. METHODOLOGY

Project-specific requirements will generally dictate the preferred type of sampling equipment used at a particular site. The following parameters should be considered: sampling depth, soil density, soil moisture, use of analyses (e.g., chemical versus physical testing), type of analyses (e.g., volatile versus non-volatile). Analytical testing requirements will indicate sample volume requirements that also will influence the selection of the appropriate type of sampling tool. The project sampling plan should define the specific requirements for collection of surface soil samples at a particular site.

Collection of Samples

- **Volatile Analyses.** Surface soil sampling for volatile organics analysis (VOA) is different than other routine physical or chemical testing because of the potential loss of volatiles during sampling. To limit volatile loss, the soil sample must be obtained as quickly and as directly as possible. If a VOA sample is to be collected as part of a multiple analyte sample, the VOA sample portion will be obtained first. The VOA sample should be obtained from a discrete portion of the entire collected sample and should not be composited or homogenized. Sample bottles should be filled to capacity, with no headspace. Specific procedures for collecting VOA samples using the EPA Method 5035 are discussed in SOP 2-7.
- **Other Analyses.** Once the targeted sample interval has been collected, the soil sample will be thoroughly homogenized in a stainless steel bowl prior to bottling. Sample homogenizing is accomplished by manually mixing the entire soil sample in the stainless steel bowl with the sampling tool or with a clean teaspoon or spatula until a uniform mixture is achieved. If packing of the samples into the bottles is necessary, a clean stainless steel teaspoon or spatula may be used.

General Sampling Procedure:

- Decontaminate sampling equipment in accordance with the Sampling and Analysis Plan (SAP) before and after each individual soil sample.
- Remove surface debris that blocks access to the actual soil surface or loosen dense surface soils, such as those encountered in heavy traffic areas. If sampling equipment is used to remove surface debris,

the equipment should be decontaminated prior to sampling to reduce the potential for sample interferences.

- When using a hand auger, push and rotate downward until the auger becomes filled with soil. Usually a 6- to 12-inch long core of soil is obtained each time the auger is inserted. Once filled, remove the auger from the ground and empty into a stainless steel bowl. If a VOA sample is required, the sample should be taken directly from the auger using a teaspoon or spatula and/or directly filling the sample container from the auger. Repeat the augering process until the desired sample interval has been augered and placed into the stainless steel bowl.

Backfilling Sample Locations:

Backfill in accordance with federal and state regulations including OAR 690-240 (e.g., bentonite requirements). The soils from the excavation will be used as backfill unless project-specific or state requirements include the use of clean backfill material.